

# Process of rehabilitation of a XIX<sup>th</sup> century building in the city of Porto. Surveys, monitoring and intervention.

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## ABSTRACT:

The present contribution details an intervention in a XIX<sup>th</sup> century building located in the Oporto Historical Centre buffer zone (UNESCO World Heritage since 1996). The building faced a series of problems related to structural instability and lack of maintenance for over half a century. The first phase incorporated surveys, monitoring and intervention on the roof.

The rehabilitation project aimed at preserving the maximum of the existing building, retaining the integrity of the former structure and making only punctual changes and substitutions where necessary. Whenever replacement was duly required, the new elements were proposed in harmonious relationship with the pre-existence without renouncing to their contemporaneity

This paper reports the methodological approach and the process of this intervention: surveys, decay mapping analysis, monitoring, project and intervention.

## 1. HISTORICAL AND URBAN CONTEXT

The building stands on Rua Alberto Aires Gouveia in an area of XIX<sup>th</sup> century extension and urban renovation (Ferrão, 1989; Nonnel, 2002)<sup>1</sup>. The former Rua do Carranca (subsequently named Rua da Liberdade before later becoming Alberto Aires Gouveia) was opened at the beginning of the XIX<sup>th</sup> century in the parish of Miragaia in Oporto. The land extending between Rua da Restauração and Rua do Carranca probably belonged to João Allen, who owned a house there in 1835<sup>2</sup>.

Although there was no construction in this area, both the B. Clark Plan (1834) and the Joaquim da Costa Lima Plan (1839) represent plots in the southern portion of Rua da Liberdade, which were urbanized later as detailed in the Perry Vidal Plan (1865). However, only in the Telles Ferreira Plan (1892) does the building appear clearly defined with the approximate perimeter that exists today and including its garden backyard<sup>3</sup> (Fig. 1).

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<sup>1</sup> For further information on Oporto's urban transformation between the 17<sup>th</sup> and the 19<sup>th</sup> centuries, see: Alves, J. J. B. F., *O Porto na Época dos Almadás*, Porto: CMP, 1988; Ferrão, B., *Projecto e transformação urbana do Porto na época dos Almadás 1758-1813*, Porto: Faup, 1989; Nonnel, A. G., *Porto 1763-1852: a construção da cidade entre despotismo e liberalismo*, Faup, 2002.

<sup>2</sup> Cfr. Historical Archive of Oporto, Livro de Plantas de Casas, no. 212.

<sup>3</sup> It was probably by the end of XIX<sup>th</sup> century that António da Costa Fontes buys several houses and land comprised between Rua da Restauração and Rua Liberdade. In 1896-1897, António da Costa Fontes ordered works in this house. Cfr Historical Archive of Oporto, Livro de Plantas de Casas, no.138, f.327-331, of 1896, and nº 186, f. 235-238, of 1897.

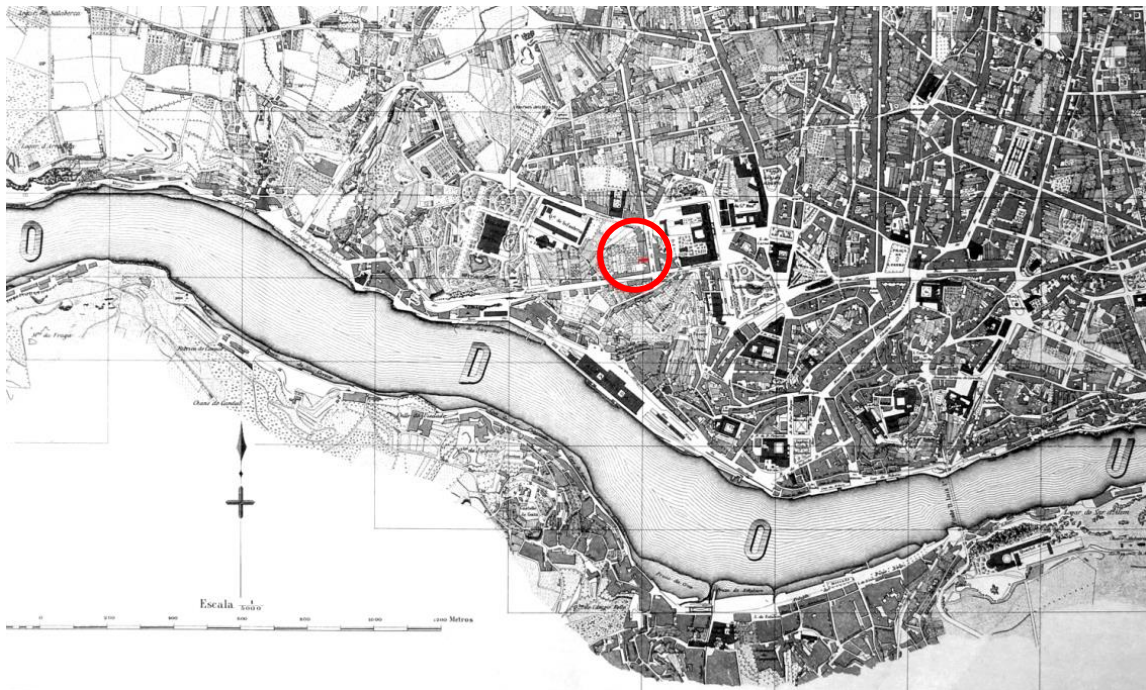


Figure 1. Building location in Telles Ferreira Plan (1892)

The building is classified as a Property of Public Interest due to its location in the “buffer zone” of the Historic Centre of Oporto, listed as world cultural heritage by UNESCO in 1996 (Loza et al, 1996). The building is currently located in ZEP/ ZAP and ZIP zone (Zone of Priority Intervention) of ACRU (Critical Area of Urban Recovery and Conversion) defined by Oporto City Council (Câmara Municipal do Porto & Porto Vivo, 2010). Moreover, the building is identified in the Porto Heritage Map<sup>4</sup> (Carta do Património) published by the Porto Municipal Council and directly linked to regulatory plans and urban municipal policies (Plano Director Municipal). Nowadays, the edifice is empty and, considering its dimension and investment needed for complete rehabilitation, there are no perspectives for its future uses and occupations.

## 2. PREEXISTING CONDITIONS

### 2.1. CONSTRUCTIVE CHARACTERIZATION

The building encloses traditional materials and techniques in accordance with the typology of preindustrial period constructive systems in Porto (V. Freitas, J. Teixeira, N. Valentim et al., 2012). Particularly, the edifice has granite masonry bearing structures finished with hydrophobic plastered mortar on the façades. The recessed floors are in plastered masonry in the main and rear façades, and the side facings are in timber panelling (“tabique”) coated with slate tiles or metallic sheeting and crowned with wooden cornices. The window frames are in wood painted in white.

The horizontal structures are oak and chestnut beams holding affixed clamping and locking substructures whether wooden floors or stucco ceilings. The roof structure is in oak and chestnut and inlaid with a substructure of rods, lining and slats to support the Marseille tile. The front eave contains a longer tile type (“canudo tile”) 70 cm in length.

<sup>4</sup> See Carta do Património, in Planta de Ordenamento, Plano Director Municipal do Porto. See [http://sigweb.cm-porto.pt/mipweb/\(S\(p3id2v4533nuevjrn0ur4m55\)\)/MapViewer/SectionsViewer.aspx?id=9](http://sigweb.cm-porto.pt/mipweb/(S(p3id2v4533nuevjrn0ur4m55))/MapViewer/SectionsViewer.aspx?id=9) [available on 30/04/2015].

## 2.2. SURVEYS, ANALYSIS AND MONITORING

The intervention was motivated by serious damage, such as the collapse of stucco ceilings due to structural problems and gravitational infiltration at several points, such as at the base of the skylight and along the exterior walls.

Prior to the intervention, precise surveys and analyses were conducted, comprising geometrical and photographic surveys, decay mapping, structural analysis and monitoring.

Considering the diversity and quality of the architectural and decorative treatment given to each room (and the precarious state of conservation), the surveys included single rooms with elevations and ceilings (Fig. 3). This precise record could also be an important source of information in the event of further irreversible damage to the applied architectural decoration (stucco, paintings, curtains, wallpaper and textiles, furniture, woodwork, mirrors, etc.).

Furthermore, analyses were conducted in the form of decay mapping, structural analysis and the monitoring of both humidity and temperature. The structural report called for the consolidation and reinforcement of the wooden structure of the roofs and the introduction of braces under some stucco ceilings and the skylight, in order to prevent damage and improve safety.

Anomalies were analysed using decay mapping in each room, resulting in a qualitative vision of the apparent damage to the masonry and partition walls, cladding, ceilings and floors, doors, woodcarving and windows. The most frequent damage consisted of cracks, the detachment of materials and coverings, stains and gaps. The cracks appeared in the ceilings and extended along the inner walls, being particularly evident in the skylight and the ceilings of the upper floor, due to structural problems, as well as the contraction and expansion of wooden elements exposed to variations in temperature and relative humidity. Occasionally the cracking caused fractures and gaps, mainly in the ceilings, as, for example, in the Music Room, a situation that was further aggravated by gravitational infiltration from the roof. The high relative humidity was also responsible for the stains in the coverings and wooden elements, highlighting the presence of saltpetre, mould and vertical drainage.

3.1 MAPA DE ANOMALIAS

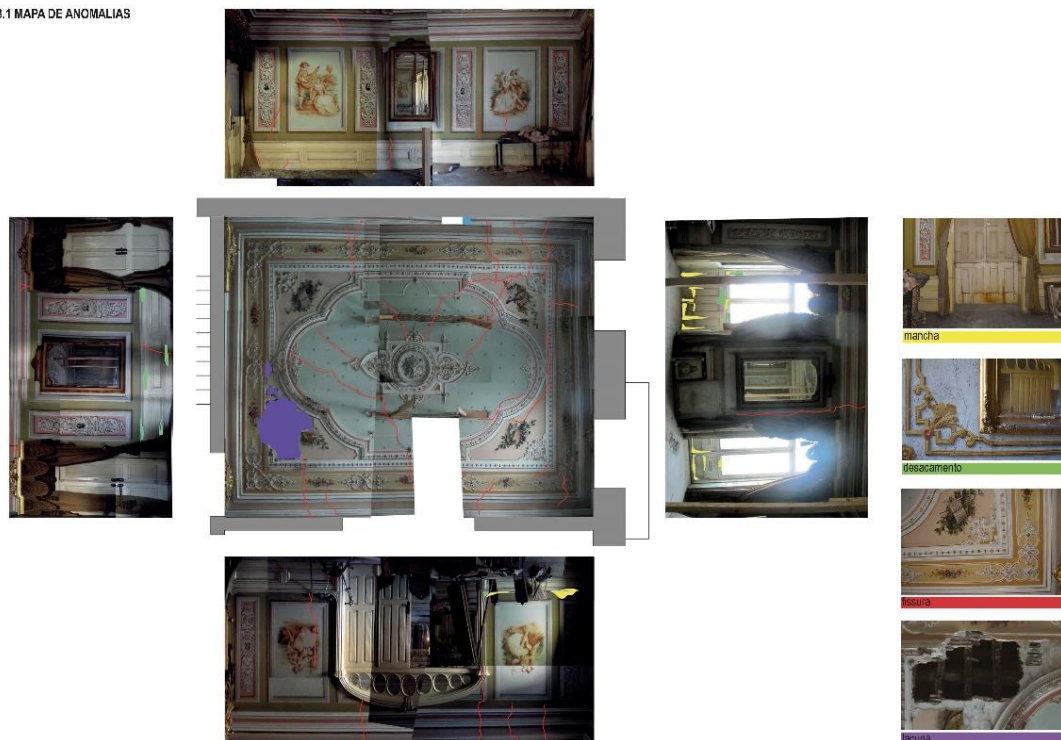


Figure 3. Decay mapping (Music room).

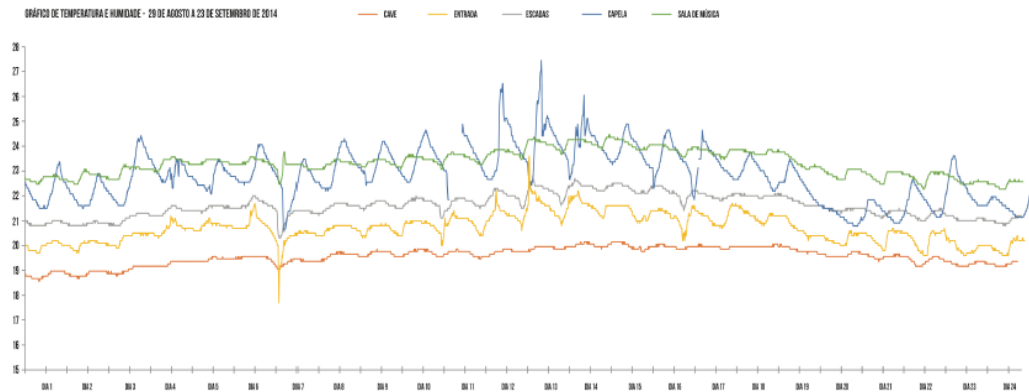


Figure 4. Temperature monitoring (from 29<sup>th</sup> august 2014 to 23<sup>rd</sup> september 2014)

The monitoring of the temperature and relative humidity, conducted at intervals of 15 minutes for a period of 25 days in the hot season (from 29 August to 23 September 2014), made it possible to understand the effects of the building's lack of use on the anomalies identified by the decay mapping (Fig. 4). The combination of a relative humidity of more than 65% and a temperature constantly above 20°C led to an increased risk of mould growth, speeding up the life cycle of wood-eating insects and encouraging the development of chemical reactions such as chromatic changes or the crystallisation of salts. The relative humidity conditions that were identified were further exacerbated by the gravitational humidity caused by leaks in the roof, which are expected to be solved with the present intervention.

### 3. INTERVENTION (ROOFS)

#### 3.1. DECAY ANALISYS AND MAPPING

The first phase focused on the rehabilitation of the roof that was already in an advanced state of degradation due to the lack of maintenance throughout various decades.

The main problems identified generally involved the deterioration of ceramic tiles, the deterioration of the timber structures (due to the presence of water, insects and fungi), the decay of the mortars, painted wooden elements and the metal features, among others problems such as (Fig. 5):

- Advanced decay of the tiles with a considerable number of them either broken or with low levels of waterproofing;
- Advanced deterioration of the eave tiles due to the presence of biological colonization and the decay of the setting mortars;
- Decay of the gable and crowning tiles alongside the rotting of the mortar fixing;
- Advanced degradation of the recessed floor metal sheeting and lack of slate tiles;
- Advanced decay of the skylight cladding sheet and its drip tray and of the upper metallic edge;
- Deterioration of the rainwater drainage system, including the metal guides, gutters, the back downpipe and the capitals;
- Decay of some timber features due to rot or insect and fungal attack (beams, rods, upper skylight structure support beam, roof lining and slats);



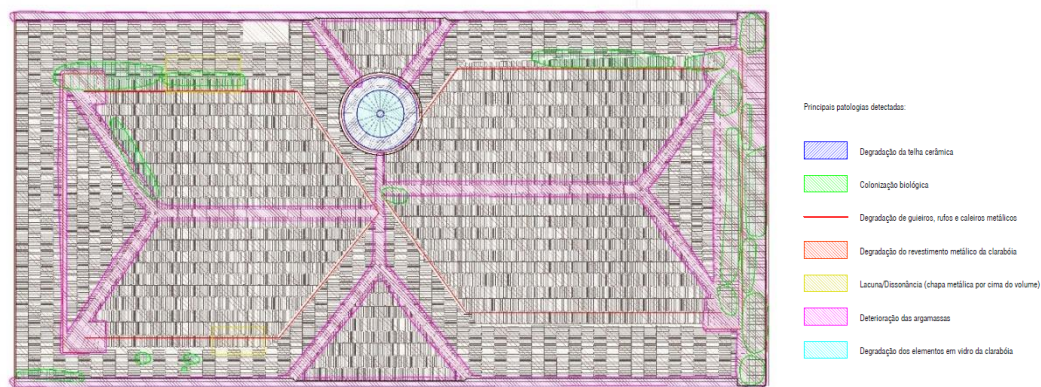


Figure 5. Decay mapping (roof)



Figure 4. Photographic survey before the intervention

### 3.2. BRIEF DESCRIPTION OF THE INTERVENTION

The objectives of this intervention involved ensuring and improving the watertight integrity of the roof and, simultaneously, retaining all of the features in good condition in order to preserve the building's constructive authenticity. With the intention of conserving the organic unity of the building, traditional materials and construction technologies were preferred as more compatible, sustainable and harmonious with the old structures.

The intervention scope foresaw only minimal structural reinforcement (ISCARSAH, 2003), preserving all the timber structures still in good condition (structural features, beams and rods, liner) involving surface cleaning and curative and preventive treatment against the action of wood-destroying agents (xylophages), except for the slats and some of the lining that could not be preserved. Where necessary, the rods, beams and wood trusses were reinforced with prosthetic pine wood treated and bonded with metal brackets or clamps. Moreover, the skylight support beam structure was enhanced by a new beam in treated pine, which was embraced with the existing through metallic reinforces; the new beam was posed in a granite interior wall in one extremity and in a new beam in treated pine in the other extremity. Besides, another reinforcing beam was introduced near the façade to improve the connection between the façade wall and the side walls (Fig. 6).

To improve the cover's impermeability, a waterproof and breathable tile was proposed (above the counter-slats and below the slats) into which the ceramic Marseille tiles are set. This solution enables the ventilation of the attic through a 1 cm spacing between board linings.

Furthermore, in order to increase project durability, improvements were made in the gable systems crowning the walls, in the rainwater drainage system (metal guides and gutters) as well as in coating the skylight in a new high performance and durability material – zinc. The introduction of this material led to the integration of contemporary features - although carefully aligned with the pre-existing and reinterpreting traditional construction systems - exploring its expressive potential particularly in the folds and in the skylight cover plate.

This approach strove for continuity with tradition, without renouncing the contemporaneous nature of the intervention searching “to 'continue-innovating', [in] a dialogue, seeking more for similarities and continuity, than cultivating the difference and rupture” (Távora 1985: 77). Maintaining that in rehabilitation interventions “conserving the integrity of what exists is very important” (Siza, 2011: 186,188), new elements are in keeping with the principles of contextual design in continuity with the pre-existing attributes: character, scale, form, composition, proportion.

Another important feature in the intervention was the preservation and improvement of natural ventilation systems: gaps between lining, breathable tile and ventilated crowning (“cumeeira”). Namely in the skylight, the mechanism of combined ventilation was recovered: air circulates under the lower horizontal steel frame towards a ventilation “chimney” in the top. These kind of passive systems such as combined natural air ventilation are extremely important for damage prevention and for the future maintenance of the buildings (Ferreira, 2011).

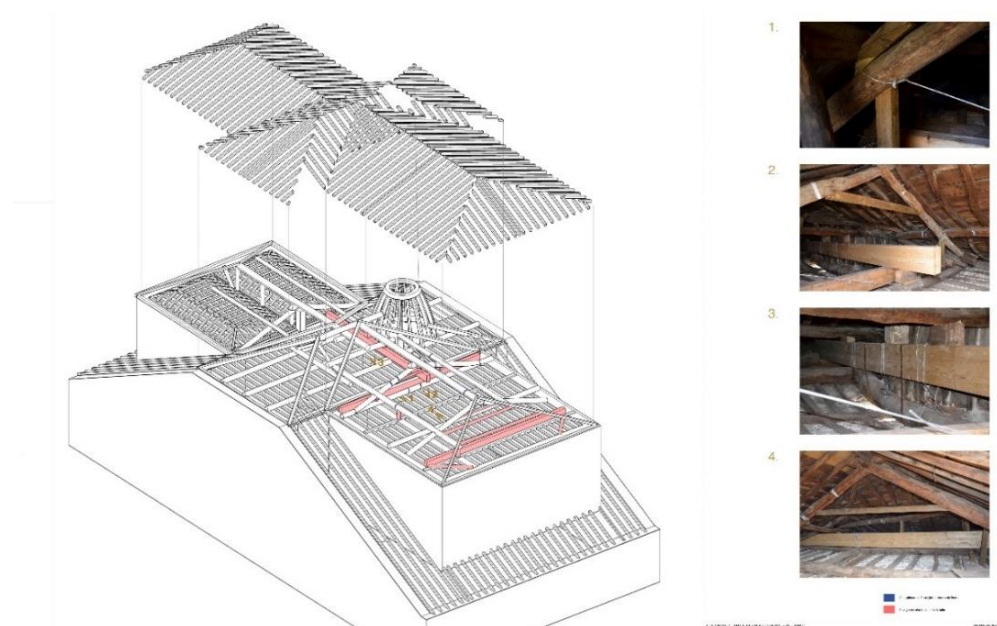


Figure 6. Axonometric representation with new structural elements in red

## 5. FINAL NOTE

The intervention strove for a conservative approach applying principles in accordance with the international declarations, charters and recommendations (ICOMOS), following an indicative methodology: (1) preliminary knowledge: surveys (historical, geometric and constructive), diagnosis: decay mapping and non-destructive inspections; (2) design project and planning; (3) intervention, acknowledging principles of compatibility and authenticity preservation; (4) preventive conservation and maintenance over time.

Hence, intervention seeks to preserve the building's authenticity and organic unity, therefore traditional techniques and materials are preferred as more compatible and sustainable. When additions are necessary for contemporary usage, the relationship between the old and the new preferentially reflects continuity and dialogue – whether material, constructive, tectonic, compositive, typological or conceptual – with contemporary or analogical expression.

Maintenance is the last phase in the process, consisting of its monitoring and preventive conservation over time, aiming at the sustainability of the site as well as to its trustworthy transmission to future generations.

## REFERENCES

Câmara Municipal do Porto & Porto Vivo, 2010. Sociedade de Reabilitação Urbana, Plano de Gestão Porto: Porto, CMP/Porto Vivo-SRU.

Ferrão, B., 1989. *Projecto e transformação urbana do Porto na época dos Almadás 1758-1813*, Porto: Faup Publicações.

Ferreira, T. 2011, “Manutenção e Património corrente. Conceitos e perspectivas”, in *Cuidar das casas: a manutenção do Património corrente*, Porto: ICOMOS/FEUP, 2011.

Freitas, V., Teixeira J., Valentim, N. et al., 2011, *Manual de Apoio ao Projecto de Reabilitação de Edifícios Antigos*, Porto: FEUP.

ISCARSAH 2003, *Principles for the analysis, conservation and structural restoration of architectural heritage*, ICOMOS.

Loza et al. 1996. *Porto a património mundial: processo de candidatura da cidade do Porto à classificação pela UNESCO como Património Cultural da Humanidade 1993*: CMP.

Nonnel, A. G. 2002. *Porto 1763-1852: a construção da cidade entre despotismo e liberalismo*, Faup Publicações.

Siza, A., 2011. *Conferencia para el CAH20*, in *Intervention Approaches in the 20th-Century Architectural Heritage*, International Conference CAH20th, Madrid, pp. 186-188.

Távora, F. 1985. *Pousada de Santa Marinha - Guimarães*, in Boletim nº 130, Barcelos: DGEMN, p. 77.